Air Quality Monitoring in Strathcona Industrial Area
Fall, 1996 (October 22 and October 28)

Alberta Environmental Protection is currently conducting an air quality monitoring program in Strathcona County. The objectives of this program are to: (1) determine air quality parameter concentrations in the community of Sherwood Park relative to air quality guidelines and to other small urban locations in the province; and (2) determine the concentrations of specific chemical species in the Strathcona industrial area and at upwind and downwind locations from the industrial area. The program began in the summer of 1996 and is expected to be completed by mid-summer of 1997.

Air quality was measured using a mobile monitoring unit at seven locations in the Strathcona industrial area. Monitoring was conducted at: Meridian St. and 122 Ave. (north site); the Petro Canada ball diamonds west of Broadmoor Blvd. and the Hwy 14X off ramp to Baseline Rd. (east sites); 24 St. and 104 Ave. (central site); near 91 Ave. and 24 St. and near 92 Ave. and Hwy 14X (south sites); and Goldstick Park (west site). Air quality parameters monitored at these locations included ozone (O_3), total hydrocarbons (THC), total oxides of nitrogen (NO_x), nitrogen dioxide (NO_2), nitric oxide (NO), hydrogen sulphide (H_2S), and sulphur dioxide (SO_2). Carbon monoxide (CO), reactive hydrocarbons (RHC) and methane (CH_4) were not monitored in the Strathcona industrial area because of space limitations on the monitoring unit.

The following is a summary of the results of the mobile air quality monitoring activities in the Strathcona industrial area during the fall of 1996 (October 22 and October 28). Additional chemicals monitored using integrated techniques (volatile organic compounds and polycyclic aromatic hydrocarbons collected as a 24-hour sample) will be reported after the monitoring program is complete.

Major Findings

- Concentrations of all air quality parameters monitored in the Strathcona industrial area were below the air quality guidelines. Maximum 1-hour average concentrations were:
  - 52% of the 1-hour guideline for O_3;
  - 20% of the 1-hour guideline for NO_2;
  - 10% of the 1-hour guideline for H_2S; and
  - 43% of the 1-hour guideline for SO_2.
- The highest oxides of nitrogen and hydrocarbon concentrations were recorded in the early morning on October 22. The major sources of these chemicals are vehicle exhaust emissions from traffic arteries in the industrial area (e.g. Yellowhead Trail, Baseline Road and 17th Street). Industrial sources may have a minor influence on THC values on the fall survey days.
- H_2S and SO_2 concentrations were generally very low on both survey days. However, an elevated SO_2 value of 0.073 ppm was recorded on the Hwy 14X off ramp to Baseline Road in the afternoon of October 28.

Ozone (O_3)

Max. 1-hour Average	1-hour Guideline
0.043 ppm	0.082 ppm

Ozone in the lower atmosphere is produced by: (1) the reaction of oxides of nitrogen and volatile organic compounds in the presence of sunlight; and (2) transport of O_3 from the upper atmosphere to ground level. Transport of O_3 from the upper atmosphere accounts for most of the background O_3 during the fall season. O_3 concentrations are generally lower in urban centres due to the destruction of O_3 by nitric oxide.

The maximum 1-hour average O_3 concentration was measured at the east monitoring site (Petro Canada ball diamonds west of Broadmoor Blvd.) from 3:00 to 4:00 pm on October 22. This maximum value is 52% of the 1-hour guideline for O_3. The daily variation of ozone followed the same pattern that is observed at other Alberta stations (lowest values in the morning in highest values in the afternoon). The exception to this pattern was in the afternoon on October 28 when O_3 values showed a substantial drop associated with the passage of a cold front coupled with strong northwest winds. This observation was also evident from data collected in Sherwood Park on October 28. Average O_3 concentrations on the two fall survey days were slightly higher than those observed in Sherwood Park, Fort Saskatchewan and Fort McMurray for the same time period. However, O_3 values were substantially lower than those recorded at the Royal Park station, located near Vegreville.

Total Hydrocarbons (THC)

Max. 1-hour Average	1-hour Guideline
THC = 3.2 ppm	no guideline

The term "total hydrocarbons" (THC) refers to a broad family of chemicals that contain carbon and hydrogen atoms. Methane, a non-reactive hydrocarbon, is the most common hydrocarbon in the earth's atmosphere. Reactive hydrocarbons such as alkenes, alkynes and aromatics are important because they can: (1) react with oxides of nitrogen in the presence of sunlight to form ozone; and (2) be toxic to humans, animals or vegetation. Sources of hydrocarbons include vegetation, vehicular emissions, gasoline marketing and storage tanks, petroleum and chemical industries, dry cleaning, fireplaces, natural gas combustion and aircraft traffic.

The maximum 1-hour average THC value was measured from 10:00 to 11:00 am on October 22 at the central site (24 St. and 104 Ave.). Overall average THC concentrations ranged from 2.0 ppm at the west site (Goldstick Park) to 2.6 ppm at the central site (24 St. and 104 Ave.). Overall average values of 2.5 ppm were recorded at the south (91 Ave. and 24 St.) and east (Hwy 14X off ramp to Baseline Road) sites. THC concentrations in the Strathcona industrial area were higher than those recorded in Sherwood Park and Beverly for the same time period. However, similar average THC values were measured at the Edmonton east, Edmonton central, Fort Saskatchewan and Fort McMurray stations on October 22 and 28. The major sources of hydrocarbons in the industrial area are vehicle exhaust emissions and fugitive emissions from industrial sources. Normal background THC concentrations are between 1.5 and 2.0 ppm.

Oxides of Nitrogen (NO_2, NO, NO_x)

Max. 1-hour Average	1-hour Guideline
NO_2 = 0.043 ppm	0.210 ppm
NO = 0.141 ppm	no guideline
NO_x = 0.177 ppm	no guideline

Oxides of nitrogen (NO_x) are the sum of nitrogen dioxide (NO_2) and nitric oxide (NO). During high temperature combustion, as in the burning of natural gas, coal, oil and gasoline, atmospheric nitrogen may combine with molecular oxygen to form NO. NO is colourless, odourless and has no known toxic effects. Most NO is rapidly oxidized to form NO_2. NO_2 is a reddish-brown gas with a pungent odour.

The maximum 1-hour average NO_2 concentration was recorded at the south site (91 Ave. and 24 St.) just before noon on October 22. This maximum value is 20% of the 1-hour guideline for NO_2. The maximum NO and NO_x concentrations were measured earlier in the morning on October 22 at the north site (Meridian St. and 122 Ave.). Higher NO values at the north site are likely due to local traffic along Meridian Road and Yellowhead Trail. Overall average NO_2 concentrations in the Strathcona industrial area were lower than those recorded at the Forest Heights and Edmonton central stations. Average NO_2, NO and NO_x concentrations were close to those recorded in Sherwood Park for the same monitoring period.

Hydrogen Sulphide (H_2S)

Max. 1-hour Average	1-hour Guideline
H_2S = 0.001 ppm	0.010 ppm

Hydrogen sulphide (H_2S) is a colourless gas with a rotten egg odour. Industrial sources of H_2S include fugitive emissions (leakages) from petroleum refineries, tank farms for unrefined petroleum products, natural gas plants, petrochemical plants, oil sands plants, sewage treatment facilities, pulp and paper plants which use the kraft pulping process, and animal feedlots. Natural sources of H_2S include sulphur hot springs, sloughs, swamps and lakes.

The maximum 1-hour average H_2S concentration was measured at the north (Meridian St. and 122 Ave.) and east (Petro Canada ball diamonds west of Broadmoor Blvd.) monitoring sites in the morning on October 22. Winds were from the southwest to west directions when H_2S was detected at these locations. Average H_2S values were lower than the detection limit of the monitoring instrument during the remaining monitoring period. Overall average H_2S values recorded during the Strathcona industrial area survey were lower than those recorded at the Sherwood Park, Elmjay, Beverly and Fort Saskatchewan stations for the same time period. Major sources of H_2S in the industrial area are fugitive emissions from industrial sources and/or the sewage treatment plant.

Sulphur Dioxide (SO_2)

Max. 1-hour Average	1-hour Guideline
SO_2 = 0.073 ppm	0.170 ppm

Sulphur dioxide (SO_2) is a colourless gas with a pungent odour. In Alberta, the major sources of SO_2 are natural gas processing plants, oil sands facilities, and power plants. Other sources include gas plant flares, oil refineries, pulp and paper mills and fertilizer plants.

SO_2 concentrations were very low at most monitoring sites on the October 22 and 28 survey days. The exception to this was on the afternoon of October 28 when a maximum 1-hour average SO_2 concentration of 0.073 was recorded on the Hwy 14X off ramp to Baseline Road. This value is less than half of the 1-hour guideline for SO_2. Winds were from the west-northwest to north with speeds of 10 to 34 km/h during this period. The most probable source of this elevated

SO_2 value is stack emissions from the Petro Canada refinery. Elevated SO_2 concentrations were not detected in Sherwood Park during this period. Overall average SO_2 concentrations measured during the fall survey days were significantly higher than those recorded at other Alberta monitoring stations.

Average Concentrations at Each Monitoring Site in the Strathcona Industrial Area (ppm)

October 22, 1996

Monitoring Site	Monitoring Period	O_3	NO_x	NO_2	NO	THC	H_2S	SO_2	Temp.*	Wind dir/spd*	Cloud*
north (Mer. St.&122 Ave.)	07:30 to 08:30	0.013	0.177	0.037	0.141	3.2	0.001	0.004	n/a	SW-WSW/1-12	n/a
east (ball diamonds)	08:39 to 09:47	0.013	0.136	0.038	0.098	2.9	0.001	0.004	n/a	SSW-W/0-15	n/a
central (24 St.&104 Ave.)	10:02 to 11:03	0.017	0.080	0.038	0.042	3.2	0.000	0.003	n/a	ENE-NW/0-11	n/a
south (91 Ave.& 24 St.)	11:11 to 12:15	0.018	0.101	0.043	0.058	2.7	0.000	0.004	n/a	SW-NNW/0-11	n/a
west (Goldstick Park)	12:28 to 13:24	0.027	0.036	0.029	0.007	2.1	0.000	0.001	n/a	SSW-N/0-8	n/a
north (Mer. St.&122 Ave.)	13:44 to 14:46	0.039	0.016	0.012	0.004	2.0	0.000	0.001	n/a	WSW-NNW/1-11	n/a
east (ball diamonds)	15:00 to 16:00	0.043	0.011	0.010	0.001	1.9	0.000	0.001	n/a	WNW-N/0-10	n/a
central (24 St.&104 Ave.)	16:21 to 17:22	0.034	0.029	0.025	0.004	2.4	0.000	0.003	n/a	WSW-NNW/0-17	n/a
south (91 Ave.& 24 St.)	17:31 to 18:33	0.020	0.034	0.028	0.006	2.3	0.000	0.000	n/a	W-NW/1-16	n/a
west (Goldstick Park)	18:51 to 19:52	0.032	0.014	0.013	0.001	1.9	0.000	0.000	n/a	W-NW/0-12	n/a

October 28, 1996

Monitoring Site	Monitoring Period	O_3	NO_x	NO_2	NO	THC	H_2S	SO_2	Temp.*	Wind dir/spd*	Cloud*
north (Mer. St.&122 Ave.)	9:51 to 10:51	0.005	0.067	0.025	0.035	2.2	0.000	0.004	n/a	SE-S/0-10	n/a
east (ball diamonds)	11:02 to 12:08	0.013	0.024	0.012	0.011	2.0	0.000	0.004	n/a	SSW-W/2-14	n/a
central (24 St.&104 Ave.)	12:41 to 13:42	0.012	0.024	0.010	0.012	2.3	0.000	0.003	n/a	WNW-NNW/1-13	n/a
south (92 Ave.&Hwy 14X)	13:50 to 14:52	0.017	0.011	0.005	0.004	2.3	0.000	0.002	n/a	NNW-N/11-30	n/a
east (Bsln. Rd.&Hwy 14X)	15:14 to 16:16	0.005	0.050	0.009	0.041	2.5	0.000	0.073	n/a	WNW-N/10-34	n/a

* Temp. and Cloud are based on observations at Sherwood Park monitoring sites. Wind is measured directly by the mobile monitoring unit.
Units are temperature [°C], wind speed [km/h] and cloud cover [% of sky coverage].

Average Concentrations at Each Monitoring Site in the Strathcona Industrial Area (ppm)							
Monitoring Site	**O_3**	**NO_x**	**NO_2**	**NO**	**THC**	**H_2S**	**SO_2**
north (Mer. St.&122 Ave.)	0.019	0.087	0.024	0.060	2.4	0.000	0.003
east (ball diamonds)	0.023	0.057	0.020	0.037	2.3	0.000	0.003
central (24 St.&104 Ave.)	0.021	0.044	0.024	0.019	2.6	0.000	0.003
south (91 Ave.& 24 St.)	0.019	0.068	0.035	0.032	2.5	0.000	0.002
west (Goldstick Park)	0.029	0.025	0.021	0.004	2.0	0.000	0.001
south (92 Ave.&Hwy 14X)	0.017	0.011	0.005	0.004	2.3	0.000	0.002
east (Bsln. Rd.&Hwy 14X)	0.005	0.050	0.009	0.041	2.5	0.000	0.073
Overall Average Concentrations on All Fall Survey Days (ppm)							
Location	**O_3**	**NO_x**	**NO_2**	**NO**	**THC**	**H_2S**	**SO_2**
Strathcona industrial area	0.019	0.049	0.020	0.028	2.4	0.000	0.012
Sherwood Park (mobile)	0.011	0.053	0.024	0.028	2.0	0.000	0.002
SIA Sherwood Park	no data	no data	no data	no data	1.9	0.001	0.002
SIA Clover Bar	no data	0.049	0.018	0.033	no data	0.000	no data
SIA Elmjay	no data	no data	no data	no data	no data	0.001	0.002
SIA Gold Bar	no data	no data	no data	no data	no data	0.001	no data
SIA Beverly	no data	no data	no data	no data	1.5	0.001	0.003
SIA Forest Height	no data	0.056	0.044	0.013	no data	no data	no data
Edmonton Central	0.007	0.084	0.030	0.054	2.3	no data	no data
Edmonton East	0.012	0.070	0.024	0.047	2.3	0.000	0.001
Fort Saskatchewan	0.015	0.036	0.015	0.020	2.3	0.001	0.003
Fort McMurray	0.013	no data	no data	no data	2.4	0.000	0.001
Royal Park	0.039	0.003	0.002	0.001	no data	no data	no data

Average Concentrations at Each Monitoring Site in the Strathcona Industrial Area (ppm)

October 22, 1996

Monitoring Site	Monitoring Period	O_3	NO_x	NO_2	NO	THC	H_2S	SO_2	Temp.*	Wind dir/spd*	Cloud*
north (Mer. St.&122 Ave.)	07:30 to 08:30	0.013	0.177	0.037	0.141	3.2	0.001	0.004	n/a	SW-WSW/1-12	n/a
east (ball diamonds)	08:39 to 09:47	0.013	0.136	0.038	0.098	2.9	0.001	0.004	n/a	SSW-W/0-15	n/a
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east (ball diamonds)	15:00 to 16:00	0.043	0.011	0.010	0.001	1.9	0.000	0.001	n/a	WNW-N/0-10	n/a
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south (91 Ave.& 24 St.)	17:31 to 18:33	0.020	0.034	0.028	0.006	2.3	0.000	0.000	n/a	W-NW/1-16	n/a
west (Goldstick Park)	18:51 to 19:52	0.032	0.014	0.013	0.001	1.9	0.000	0.000	n/a	W-NW/0-12	n/a

October 28, 1996

Monitoring Site	Monitoring Period	O_3	NO_x	NO_2	NO	THC	H_2S	SO_2	Temp.*	Wind dir/spd*	Cloud*
north (Mer. St.&122 Ave.)	9:51 to 10:51	0.005	0.067	0.025	0.035	2.2	0.000	0.004	n/a	SE-S/0-10	n/a
east (ball diamonds)	11:02 to 12:08	0.013	0.024	0.012	0.011	2.0	0.000	0.004	n/a	SSW-W/2-14	n/a
central (24 St.&104 Ave.)	12:41 to 13:42	0.012	0.024	0.010	0.012	2.3	0.000	0.003	n/a	WNW-NNW/1-13	n/a
south (92 Ave.&Hwy 14X)	13:50 to 14:52	0.017	0.011	0.005	0.004	2.3	0.000	0.002	n/a	NNW-N/11-30	n/a
east (Bsln. Rd.&Hwy 14X)	15:14 to 16:16	0.005	0.050	0.009	0.041	2.5	0.000	0.073	n/a	WNW-N/10-34	n/a

* Temp. and Cloud are based on observations at Sherwood Park monitoring sites. Wind is measured directly by the mobile monitoring unit.
Units are temperature [°C], wind speed [km/h] and cloud cover [% of sky coverage].

Average Concentrations at Each Monitoring Site in the Strathcona Industrial Area (ppm)							
Monitoring Site	**O_3**	**NO_x**	**NO_2**	**NO**	**THC**	**H_2S**	**SO_2**
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south (91 Ave.& 24 St.)	0.019	0.068	0.035	0.032	2.5	0.000	0.002
west (Goldstick Park)	0.029	0.025	0.021	0.004	2.0	0.000	0.001
south (92 Ave.&Hwy 14X)	0.017	0.011	0.005	0.004	2.3	0.000	0.002
east (Bsln. Rd.&Hwy 14X)	0.005	0.050	0.009	0.041	2.5	0.000	0.073
Overall Average Concentrations on All Fall Survey Days (ppm)							
Location	**O_3**	**NO_x**	**NO_2**	**NO**	**THC**	**H_2S**	**SO_2**
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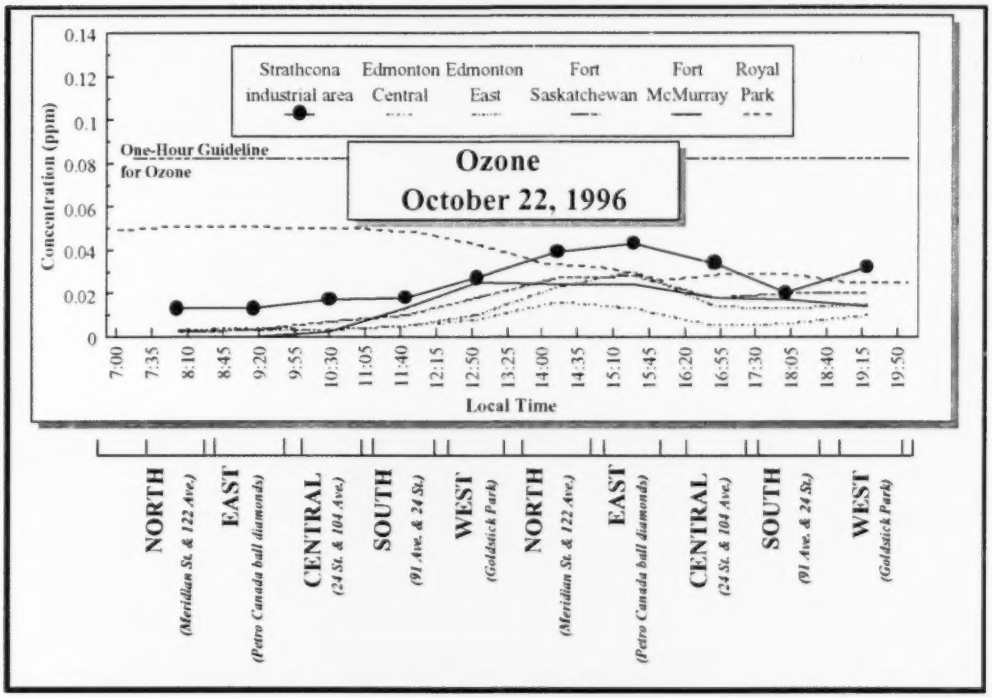
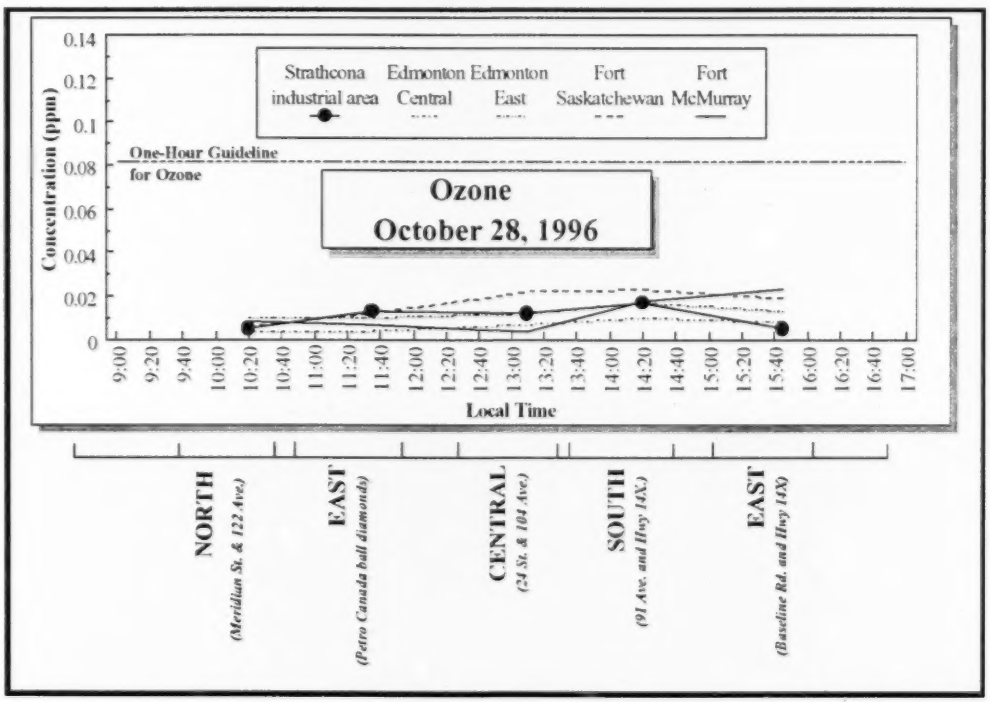
Sherwood Park (mobile)	0.011	0.053	0.024	0.028	2.0	0.000	0.002
SIA Sherwood Park	no data	no data	no data	no data	1.9	0.001	0.002
SIA Clover Bar	no data	0.049	0.018	0.033	no data	0.000	no data
SIA Elmjay	no data	no data	no data	no data	no data	0.001	0.002
SIA Gold Bar	no data	no data	no data	no data	no data	0.001	no data
SIA Beverly	no data	no data	no data	no data	1.5	0.001	0.003
SIA Forest Height	no data	0.056	0.044	0.013	no data	no data	no data
Edmonton Central	0.007	0.084	0.030	0.054	2.3	no data	no data
Edmonton East	0.012	0.070	0.024	0.047	2.3	0.000	0.001
Fort Saskatchewan	0.015	0.036	0.015	0.020	2.3	0.001	0.003
Fort McMurray	0.013	no data	no data	no data	2.4	0.000	0.001
Royal Park	0.039	0.003	0.002	0.001	no data	no data	no data

Fall, 1996

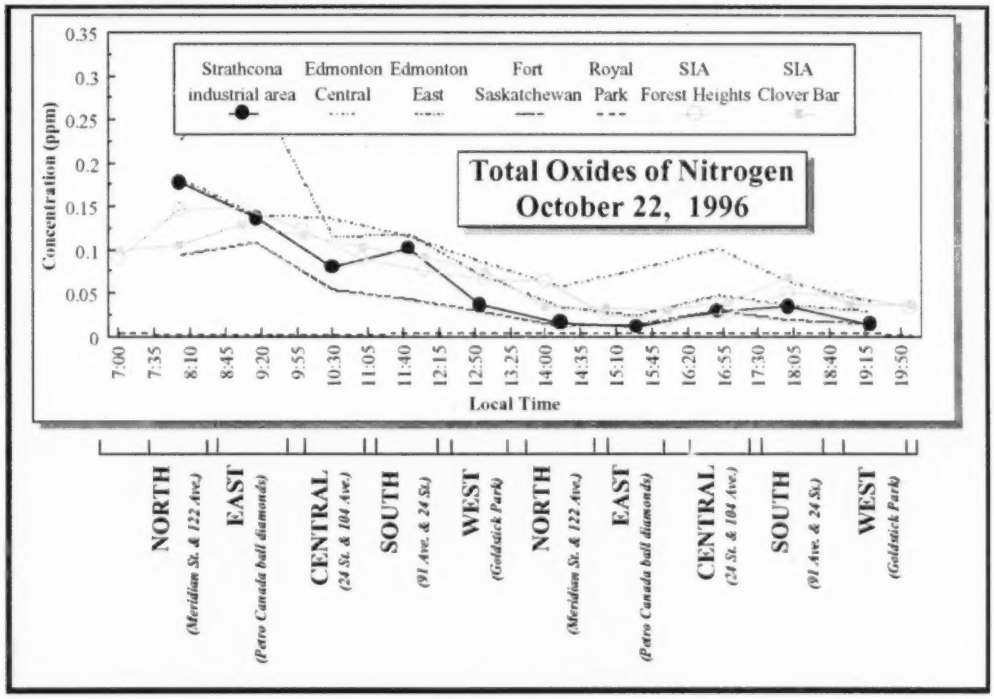
Average Ozone Concentrations in Strathcona Industrial Area

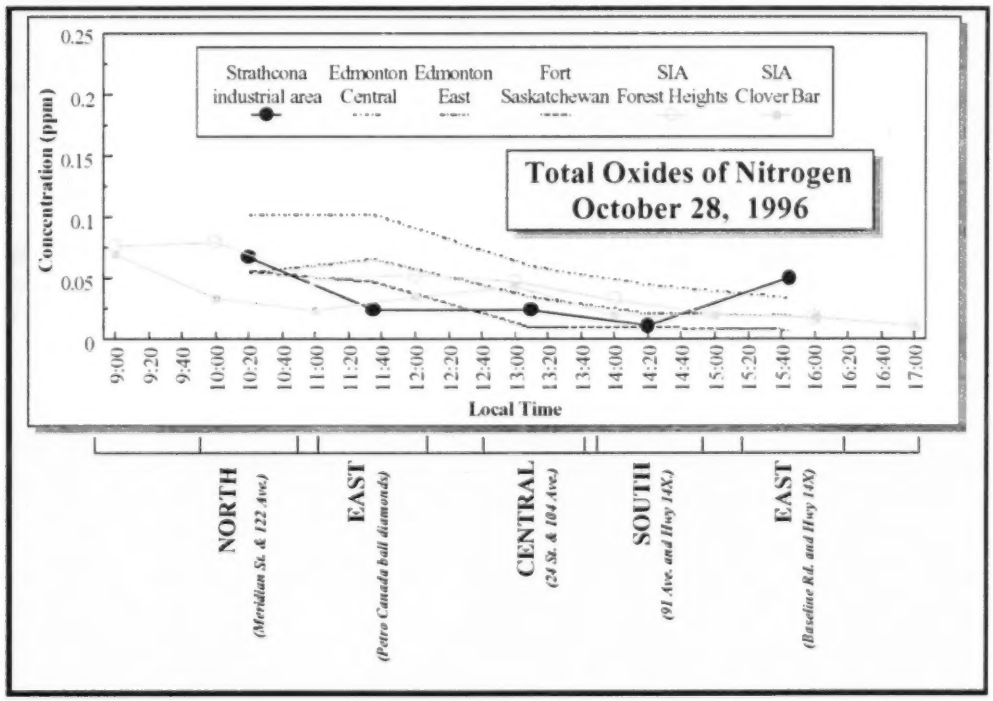




Fall, 1996

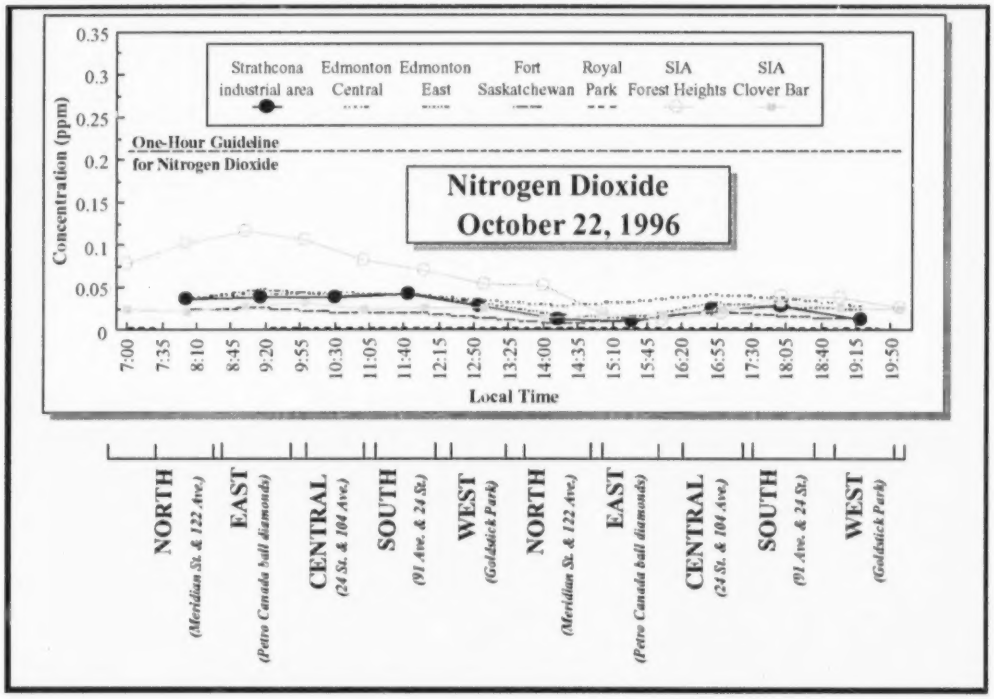
Average Total Oxides of Nitrogen Concentrations in Strathcona Industrial Area

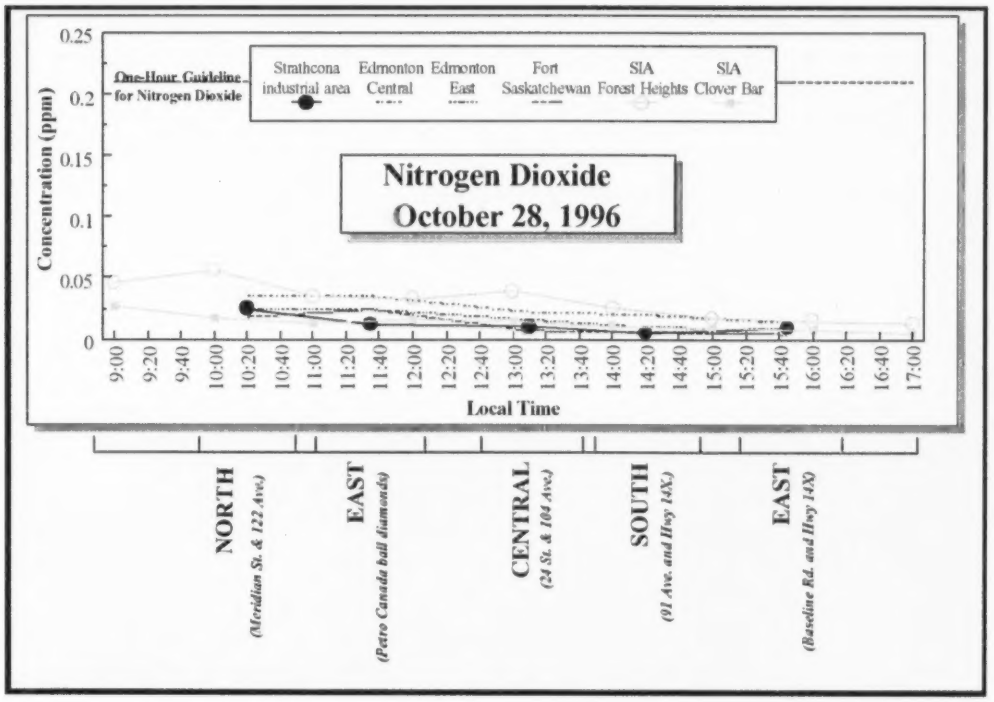




Fall, 1996

Average Nitrogen Dioxide Concentrations in Strathcona Industrial Area





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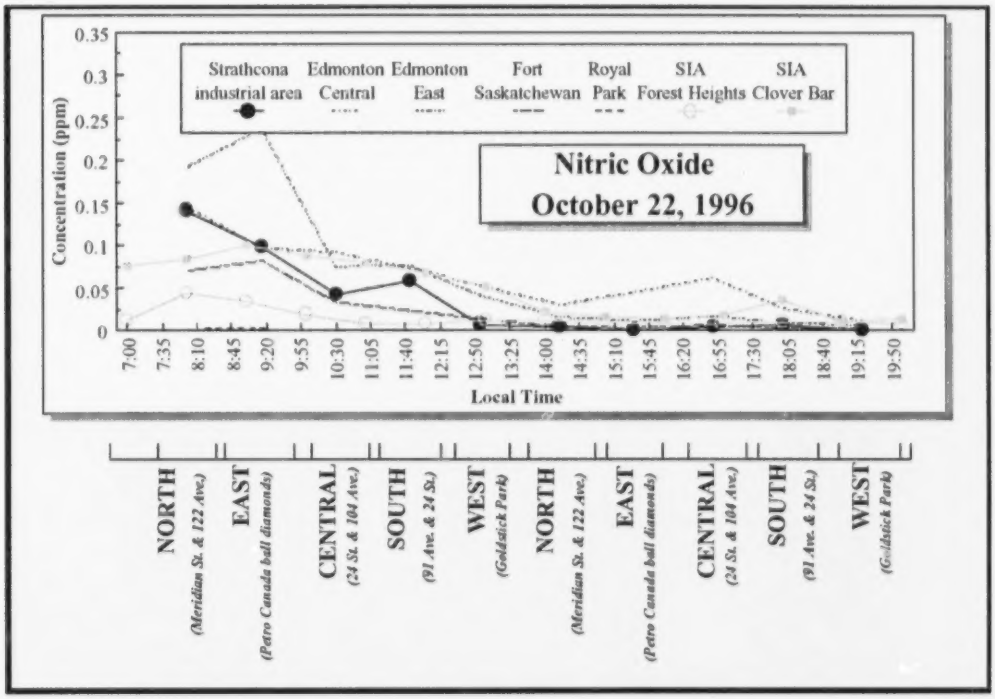
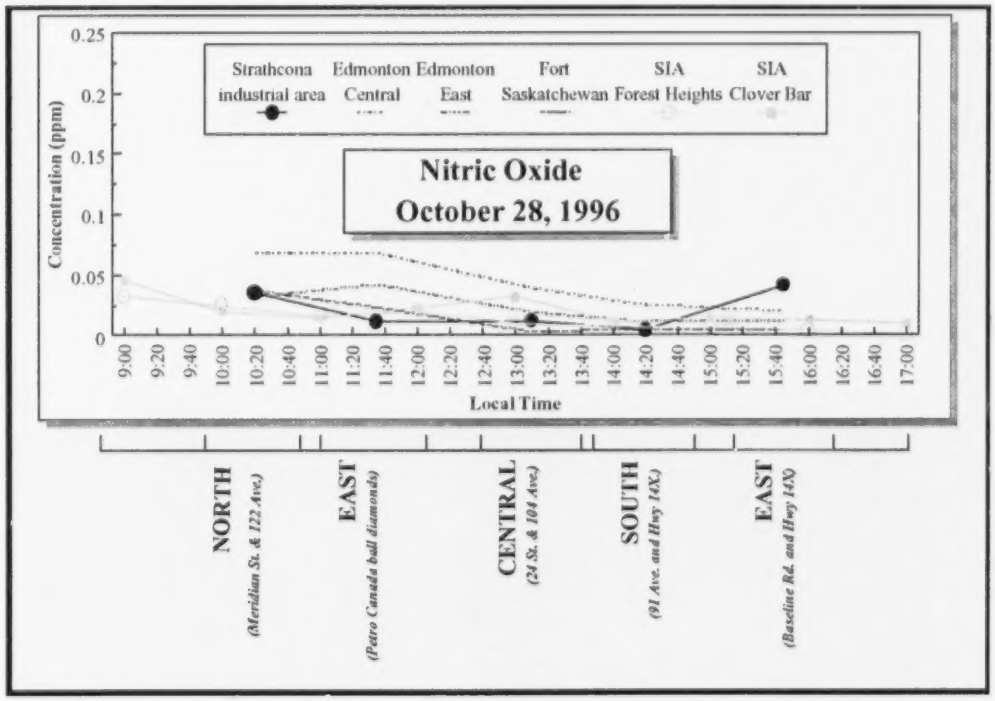
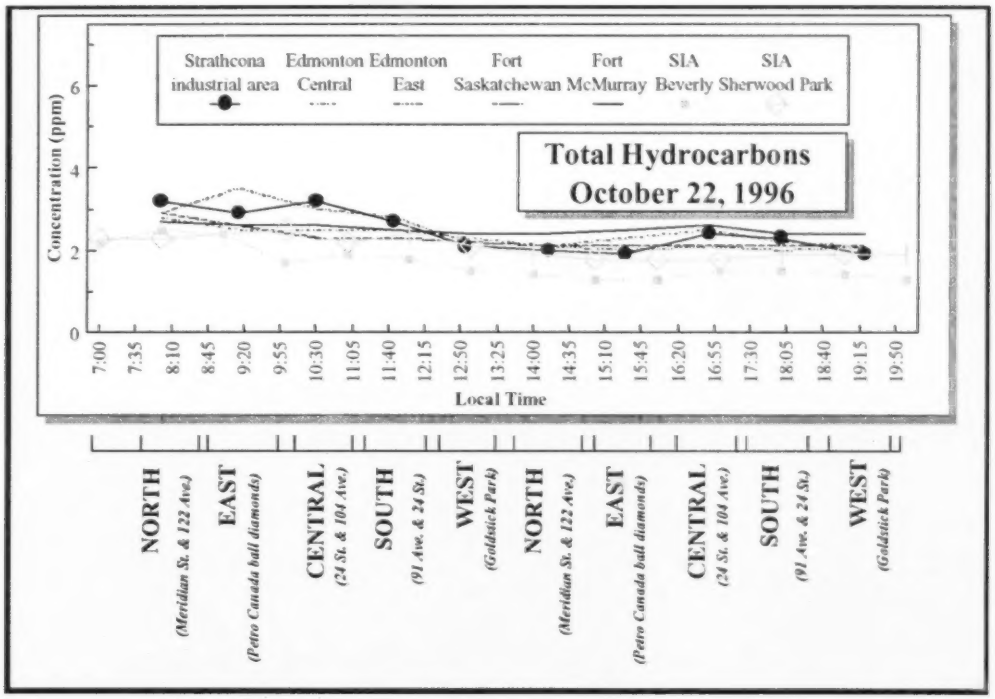
Average Nitric Oxide Concentrations in Strathcona Industrial Area

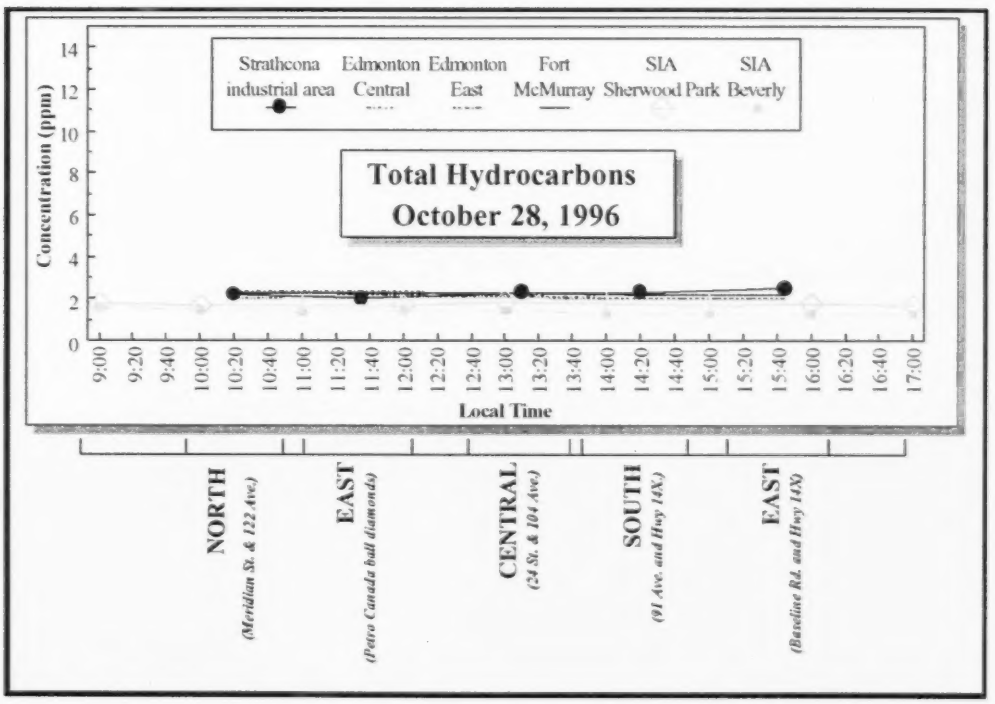




Fall, 1996

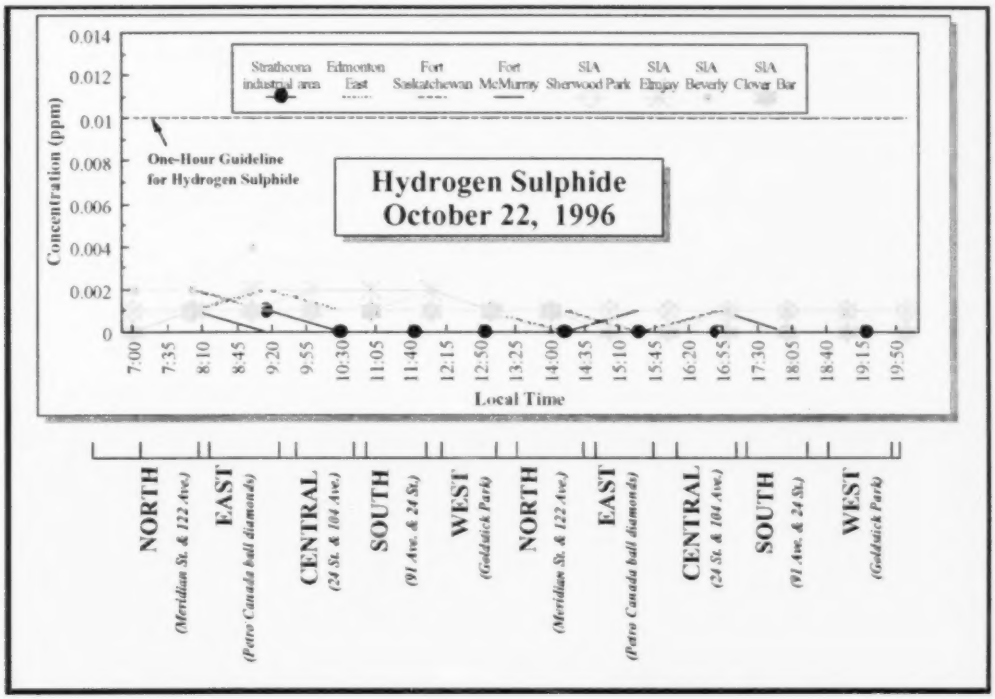
Average Total Hydrocarbon Concentrations in Strathcona Industrial Area

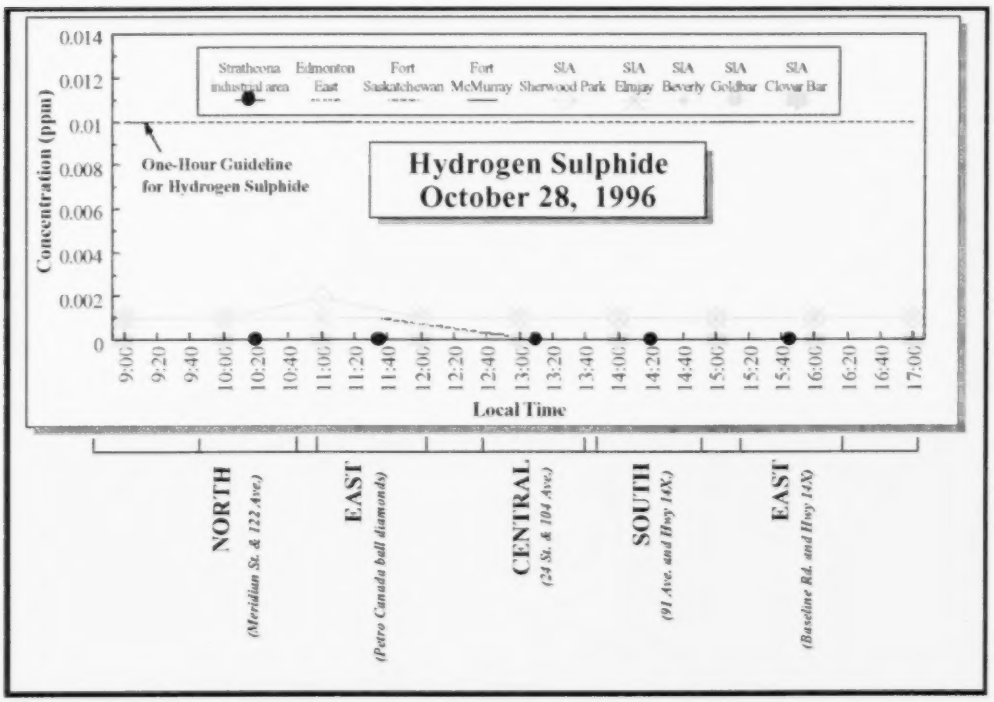




Fall, 1996

Average Hydrogen Sulphide Concentrations in Strathcona Industrial Area





Fall, 1996

Average Sulphur Dioxide Concentrations in Strathcona Industrial Area